Exhibit No. 1

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Updated Health Hazard Evaluation

DATE: July 9, 2004 DRAFT DRAFT DRAFT

TO: Doug Uelmen, BPV QA

FROM: David Ciavarella, M.D.

RE: Limb Fractures of Recovery® Filter

Summary:

Conclusion: The Severity category for the risk of thrombus-associated filter migration is Catastrophic, and the Frequency category is Remote (approximately 0.05%). The Hazard Risk Matrix Number is 8.

Description of the Problem: From January 2002 through June 2004, there have been 17 reports of limb fractures of the Recovery Filter, part of the Recovery Filter System for use in the Vena Cava. During this period, approximately 12,700 units have been sold. Assuming about 2500 units on the shelf (based on 2.5 units each for 992 accounts), about 10,200 Recovery filters have been implanted. The reported fracture rate is thus 17/10,200, a rate of 0.2% or 1 per 600 filters implanted. Fifteen fractures were noted at the time of retrieval (see below); thus, the rate of symptomatic fractures is 2/10,200, 0.02% or 1 per 5,100 filters implanted. The reported rate of serious injuries due to Recovery fracture (see below) is 1/10,200, 0.01% or 1 per 10,000 filters implanted.

In 1 of the 17 reports, the filter was "slightly angulated" upon deployment. Placement was reported as normal in 6 cases and no information about the placement of the filter is available in the remaining 10 cases. The indications for filter placement were prophylactic in 7 cases, unknown in 5 cases, and on-label in 5 cases. The fractured limbs were discovered at the time of scheduled filter retrieval in 15/17 cases (88%). None of these 15 patients had symptoms related to their fractured filter or retained filter fragments, either before or after retrieval. Two of the 17 patients (12%) presented with symptoms that prompted evaluation of the filter. One patient underwent a CT scan for a complaint of chest pain. The filter arm was noted in the R ventricle, but the patient's physicians were unable to state that the filter fragment was the cause of the chest pain. In the second symptomatic case, the patient presented with sudden shortness of breath and syncope. Hemopericardium and cardiac arrhythmia were diagnosed. A detached filter arm was noted in the ventricular wall, and it was removed during open heart surgery.

In 6 of the cases, hooks (leg ends) were detached; none of them were retrieved, i.e., they all remain in the patient, presumably bound to the wall of the inferior vena cava (IVC). A total of 20 arm fragments were reported in 14 cases (3 patients had detached hooks and arms). Eleven of 20 arms (55%) remain in the patient, and in 6 patients (30%), the detached arms migrated to the heart or lungs. Two detached arms have not been located; at least 1 of these is thought to remain *in vivo*. Information concerning the size of the retained filter fragments is available in only 4 cases; the hooks range in size from 3.6 to 4.1 mm, while the size of the only measured arm fragment was 21.6 mm. The time range for discovery of the fracture after implantation is 30 to 237 days, with a median time of 95 days.

The root cause of the fractures has not been determined, and an in vitro test method to simulate the in vivo environment does not yet exist. The arm fractures have occurred in a consistent location at the top of the filter.

The Actual Occurrence of Injuries: Serious injury has occurred in only 1 patient, the one in which open heart surgery was required to remove a filter arm that had pierced the ventricle and given rise to syncope

[redacted]

presumed due to an arrthymia. Another patient presented with chest pain of undetermined origin. The remaining cases have not reported symptoms or associated injury up to the time of this HHE.

Human Exposure to the Problem: As noted above, about 10,000 Recovery filters have been placed.

General Consequences: Most cases of filter fracture, both those reported here and those in the literature, are without consequence.[1,2] As seen in one case associated with the Recovery filter, migration of filter fragments to the heart or lung has the potential to cause tissue erosion and associated cardiac arrhythmias and tamponade, pulmonary hemorrhage and airway damage. Any patient with a patent foramen ovale is at additional risk of paradoxical embolization of the filter fragments, with the possibility of stroke or other end organ damage.

Population Exposed to the Risk: All patients in whom a vena cava filter is placed are at risk for this complication.

Mitigating/Predisposing Factors in the Population at Risk: Unknown. It is theoretically possible that hemodynamic stresses predisposing to fracture might result from mis-alignment of the filter in the IVC. However, the reports do not include evidence or even suspicion of mis-alignment.

Nature & Seriousness of the Risk: The effect of filter fracture is no discernible effect in most cases. Serious injury or even sudden death may occur in rare cases. In the MAUDE database, 25 cases of fractured IVC filters from manufacturers other than CR Bard are listed for the period of 2000 through 1Q2004. No deaths were reported, and serious injury was reported in 3 cases (1 case: fragment pierced the kidney; 1 case – fragments pierced the spine and aorta; 1 case – fragment lodged in the liver).

Likelihood of Occurrence of the Problem: No well-controlled trial exists to answer this question definitively for other filters. Review of the literature reveals a risk of filter migration in the range of a few percent. Kinney quotes a fracture rate of 1%,[1] while Streiff quotes rates from published studies of 0%, 1.7%, 2.8% and 14.1%, respectively, for the Greenfield, Vena Tech, Bird's nest and SNF filters.[2] Greenfield and Proctor[3], Ferris et al.,[4] and McCowan et al.[5] quote rates of fracture of 0.05%, 2%, and 10%, respectively.

The MAUDE database contains 25 reports of filter fracture from 4 manufacturers other than CR Bard in the period of 2000 through 1Q2004. Market information permits an estimate of about 425,000 IVC filters implanted from these 4 manufacturers during this time. Symptoms and serious injury were reported in 3 cases each, and death in no cases. The *MDR rates* of complications for other manufacturers filter are therefore:

Overall fracture rate:	25/425,000, 0.006% or 1 per 17,000 filters
Symptomatic rate:	3/425,000, 0.0007% or 1 per 141,667 filters
Serious injury rate:	3/425,000, 0.0007% or 1 per 141,667 filters
Death rate:	0%

These MDR reported fractures occurred in permanent filters. There have been no reports of fracture in 2 retrievable filters, the Cook Tulip and Cordis Optease, with an estimated 4,000 and 1,500 filters implanted, respectively.

Reported fracture rate data for the Recovery filter are as follows:

Overall fracture rate:	17/10,200, 0.2% or 1 per 600 filters
Symptomatic rate:	2/10,200, 0.02% or 1 per 5,100 filters
Serious injury rate:	1/10,200, 0.01% or 1 per 10,200 filters
Death rate:	0%

These MDR rates are not directly comparable to the observed rates with the Recovery filter for several reasons. First, the MAUDE database reflects only those events reported by the manufacturers, who can differ widely in their interpretation of reporting requirements. Thus different manufacturers may not classify all episodes of fracture as MDR reportable. Perhaps more importantly, however, the Recovery filter is a retrievable filter, and the fracture event was discovered prior to retrieval in 88% of cases (15/17) at a median time of 95 days after implantation. Fractures in permanent filters are discovered only incidentally, as routine monitoring of implanted filters is not common practice. This could lead to an underreporting bias for the permanent filters. Although no fractures have been reported to date for the other retrieval filters, the estimated number implanted is low. In addition, these filters are retrieved relatively soon after implantation. The mean (range) days before retrieval for Optease and Tulip are 16(3-48 days) and 11(2-20),[6,7] respectively, timeframes in which no Recovery filter fractures were reported.

Likelihood of Harm if the Problem Occurs: Filter fragments which remain attached to the IVC, or migrate to a similar location, are theoretically capable of causing tissue erosion and foreign body reactions of various kinds. However, as observed in these cases and from literature review, they are generally of little clinical consequence. Penetration of the IVC wall by intact filters in not infrequent (reported to occur from 0-41% of cases); however, serious injury is rare. Migration of metal fragments to the heart or lung presents the possibility of cardiac or pulmonary injury with serious clinical consequences. In patients with a patent foramen ovale, left sided embolism is possible, with attendant risk of stroke or other end organ damage. The likelihood of harm caused by fracture of the Recovery filter can be assessed as follows:

Likelihood of migration to heart or lung: 6(7)*/10,200, 0.06% (0.07%), or 1 in 1,700 (1457)
Likelihood of serious injury: 1/10,200, 0.01% or 1 in 10,200

* 6 fragments are known to have gone to heart or lung; the in vivo location of 1 fragment is unknown

Is the Product Essential to Health: Yes. It is particularly important in patients with a limited time frame of high risk of thromboembolism for whom anticoagulation if contraindicated or ineffective (about 20% or more of patients).

Is there an Alternative Available: Yes. Alternative IVC filters exist, but the ability to retrieve the Recovery filter in patients with transient risk of venous thromboembolism makes it an important treatment option for many patients.

Must the Problem Device be Removed or Corrected Surgically: Yes, in some cases.

Is the Problem Expected & Within an Acceptable Statistical Range: See answers above for Likelihood of Occurrence and Likelihood of harm. Statistical analysis of hazard rates for Recovery versus other filters is not directly possible, due to lack of comparable datasets. Filter fracture and consequent injury rates for Recovery are well below those reported in the literature, but substantially above those reported as MDRs by other filter manufacturers. For the reasons noted above, however – primarily retrievability features – data allowing a direct comparison of the recovery filter with any other IVC filter are not available.

Can the Problem be Corrected in the Field: Percutaneous retrieval of the filter fragments is sometimes possible, leading to correction/mitigation of the migration risk. However, when the fragment is in a difficult location, retrieval may be impossible or contraindicated.

Is the Problem or Health Hazard Obvious to the User: As mentioned above, filter fracture is a known complication of IVC filter placement, and information concerning this hazard has been placed in the Recovery IFU. However, there is no way to predict which patients will develop this complication. More fre-

quent monitoring of the filter once placed may facilitate discovery of abnormal placement (a *possible* but not proven predisposing factor for fracture) or indeed of a fractured filter, but could not prevent all potential adverse events.

Can the Product Continue to be Used with Proper Warnings: Yes.

Is the Device Used Only by Specially Trained Health Care Professionals: Yes.